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Yukon Flats National Wildlife Refuge Report – 2016-001

2014 and 2015 aerial scoter and scaup surveys, Alaska:

Yukon Flats National Wildlife Refuge (NWR) annual monitoring report, and

Expanded survey of Tetlin, Kanuti, Koyukuk and Nowitna NWRs, Minto Flats State Game Refuge, and lake areas south of Tanana Village

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Photo by Steve Berendzen

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Aerial scoter and scaup monitoring survey of the Yukon Flats National Wildlife Refuge (NWR), and expanded survey of Tetlin, Kanuti, Koyukuk and Nowitna NWRs, Minto Flats State Game Refuge, and lake areas south of Tanana village, Alaska – 2014 and 2015

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Abstract:

The thirteenth and fourteenth annual aerial surveys to monitor scoter and scaup populations on the Yukon Flats National Wildlife Refuge were conducted 5 – 8 June, 2014, and 6 – 9 June, 2015. The survey area (9,728 km^2) consisted of four strata, including 58 total transects (678 km^2 sampled area). White-winged scoters accounted for 99%, and surf scoters accounted for the other scoter species observed in 2014 and 2015. The number of white-winged scoters estimated in the study area in 2014 and 2015 (11,222 and 10,102, respectively) during the breeding season was lower than the previous thirteen-year mean (2001-2005 and 2007-2013) of 15,403. No black scoters were observed in 2014 or 2015. The scaup monitoring index for 2014 and 2015 was 24,668 and 22,457, respectively, which was lower than the average index value for 2002 – 2013 (26,689). Pacific loons and trumpeter swans were counted opportunistically. In 2014 and 2015, a monitoring index for Pacific loons was estimated at 1,672 and 1,573, respectively, which was not significantly different than the 7 year average from 2007 – 2013 (1,714). The trumpeter swan population index was 836 in 2014, which was similar to the previous 7 year average from 2007 – 2013 (864). In 2015, the trumpeter swan population index was 1,601, which was inflated due to a single observation of a group of 50 swans.

To better document the distribution of white-winged scoters and scaup in interior Alaska, an expanded survey was conducted in 2014. Study areas were delineated based on previous observations and the occurrence of high concentrations of lakes and ponds. Six additional study areas included an area south of Tanana Village, Minto Flats State Game Refuge, and Tetlin, Kanuti, Koyukuk and Nowitna refuges. The highest densities of white-winged scoters (1.15 birds/km^2) were observed at Yukon Flats. Densities in other areas were less than half the densities documented at Yukon Flats, with 0.00 (Nowitna Refuge) to 0.62 birds/km^2 (Tetlin Refuge). Surf Scoter and Black Scoter densities were low in all areas (0.00 – 0.19 birds/km^2). Scaup densities were the highest at Tetlin Refuge (3.20 birds/km^2), and ranged from 0.14 (Nowitna Refuge) to 2.54 (Yukon Flats Refuge) in other areas.

Key Words: aerial survey, Yukon Flats, Kanuti, Tetlin, Koyukuk, Nowitna, Tanana, Minto Flats, white-winged scoter, surf scoter, lesser scaup, monitoring

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Data and conclusions presented in this report are preliminary and are not for publication or citation in published manuscripts without permission from the author.

INTRODUCTION

Waterfowl were a primary purpose for the establishment of Yukon Flats National Wildlife Refuge due to high densities of breeding birds. In particular, Yukon Flats has the largest breeding population of white-winged scoters (*Melanitta deglandi*) and lesser scaup (*Aythya affinis*) in Alaska (Bellrose 1980, King and Lensink 1971, Lensink 1965, Palmer 1976). White-winged scoters were identified as a high priority conservation species by Sea Duck Joint Venture (Sea Duck Joint Venture Management Board 2008, Sea Duck Joint Venture 2013); Migratory Bird Management (MBM) developed a white-winged scoter Action Plan in 2011 to address critical information needs (USFWS 2011); and USFWS, Alaska Region, identified white-winged scoters and lesser scaup as priority species in 2013. In 2016 conservation framework plans were developed for lesser scaup and white-winged scoter. White-winged scoters and scaup are of conservation interest because:

1) They have exhibited substantial population declines throughout their North American breeding grounds, with the steepest decline in the Canadian western boreal forest and a more gradual decline in the Yukon Flats, Alaska (Afton and Anderson 2001, Alberta Sustainable Resource Development 2002, Austin et al 2000),
2) They breed primarily in boreal forests of Canada and Alaska (Bellrose 1980), where ecological shifts from projected climate change are expected to be the greatest,
3) Little is known about white-winged scoter populations, with basic information lacking about their natural history, vital rates, population status and trends,
4) White-winged scoters' breeding range has retracted north since 1900 (Alberta Sustainable Resource Development 2012),
5) Breeding population estimates for combined scaup species (lesser and greater scaup) have been below the North American Waterfowl Management Plan population goal of 6.3 million since the late 1970's (U.S. Fish and Wildlife Service 2013), and
6) Both species are hunted throughout their range, including spring subsistence waterfowl hunts on Yukon Flats, where white-winged scoters are the preferred species.

Existing large scale waterfowl monitoring surveys such as the Alaska-Yukon Waterfowl Breeding Population Survey (Mallek and Groves 2011) are not temporally designed to monitor scoters and scaup, which are among the latest migrants to arrive on their breeding grounds (Lensink 1965). Surveys are timed for peak detectability of dabbling ducks, whose breeding chronology is approximately 3 weeks earlier than for scoters and scaup (Mallek 2003). Scoter and scaup estimates during these surveys are expected to be highly variable due to birds migrating through, or having not yet arrived, at the surveyed breeding area (Kehoe 2002, Afton and Anderson 2001).

The Yukon Flats survey was initiated in 2001 (Mallek 2003, Mallek 2006) to identify peak detectability and provide monitoring data primarily for white-winged scoters (*Melanitta fusca*) that breed on the Yukon Flats. Due to the late nesting efforts by scaup, they were added to this monitoring survey in 2002. The Yukon Flats survey is the most spatially extensive survey of scoters and scaup throughout their breeding range.

To provide regional population context to the Yukon Flats survey and better document the distribution of white-winged scoters and scaup in interior Alaska, an expanded survey was conducted in 2014. The following basic approach was used: 1) map potential white-winged scoter and lesser scaup breeding areas in boreal Alaska and Canada using existing waterfowl survey data and GIS data-layers, 2) design and implement an inventory of identified breeding areas, and 3) design an expanded breeding pair monitoring survey to make regional population inference. Expanded efforts in 2014 included steps 1 – 2.

STUDY AREA AND METHODS

Study Area and Survey Design

The Yukon Flats study area (9,728.3 km^2) included 58 transects systematically located in four strata within the Yukon Flats where previous surveys (Platte and Butler 1992) indicated relatively high scoter densities (Figure 1). In 2014, 6 additional study areas were delineated based on previous white-winged scoter observations and the occurrence of high concentrations of lakes and ponds (Figures 5 and 6). These included an area south of Tanana Village, Minto Flats State Game Refuge, and Tetlin, Kanuti, Koyukuk and Nowitna refuges. Previous observations were from expanded breeding pair surveys conducted by the Division of Migratory Birds during peak dabbler detectability, prior to scoter and scaup peak detectability.

Transects were 400 meters wide resulting in 678.4 km^2 of sample area in Yukon Flats, and 994.5 km^2 in the expanded sample area. The survey was flown at 100-150 feet above ground level and 90-105 mph. Aircraft navigation and altitude were maintained with a Global Positioning System (GPS) and altimeter, respectively. Scoters and scaup were recorded during the survey, and a circling maneuver was used to positively identify scoters to species when necessary. Additionally, loons and swans were recorded to compare estimates with the scheduled August loon survey.

The survey was temporally designed to occur when the highest numbers of indicated breeding white-winged scoters were present in the survey area. Previous replicate scoter surveys of the Yukon Flats (Mallek 2003) indicated that the end of the first week through the second week of June was the most appropriate time to monitor white-winged scoters. Additionally, this time period is supported by nesting data of white-winged scoters on the Yukon Flats where the median dates of nest initiation were 20 and 19 June in 2003 and 2004, respectively (D. Safine, unpubl. data). Therefore, the survey occurs when most females are on the water, prior to nesting.

Survey Procedures

Observations were recorded directly into laptop computers as sound files using a computer program developed by John Hodges (USFWS, Region 7, Waterfowl Management-Juneau). Each laptop computer (one for each observer) was linked to a GPS unit. The computer program simultaneously recorded observations and their geographic coordinates into linked sound and ASCII files, respectively. A second computer program, also developed by John Hodges, was used on the ground to replay the linked sound files and produce transcribed ASCII files. The transcribed ASCII files were then used for data analyses.

A Cessna 185, Found Bushhawk or Scout float equipped aircraft were used to conduct the surveys (Table 1). Observations of scoters and scaup were recorded according to breeding pair survey protocol (USFWS and CWS 1987). All observations of lone male scoters and scaup (drakes) were recorded as singles. Drakes in flocks were recorded as flocked drakes. A male scoter or scaup in close association with a female of the same species was recorded as a pair. Scoters and scaup in mixed-sex groupings of three or more of the same species which could not be separated into singles and pairs were recorded as groups (a hen and two drakes were recorded as a pair and a single). Females not accompanied by drakes were not counted.

Statistical Methods

Following standard waterfowl breeding population survey data protocol (Smith 1985, USFWS and CWS 1987), all observations of lone scoter drakes, flocked scoter drakes (<5), and scoter and scaup pairs were doubled for analyses. Observations of lone scaup drakes, and flocked scaup drakes were not doubled for analyses. Groups of scoters and scaup were not doubled for analyses.

Population indices and variance estimates were calculated using standard statistical procedures for stratified analyses as described by Smith (1995). Densities of white-winged scoters and scaup were estimated per strata per square kilometer. Visibility correction factors were not incorporated in the population indices.

RESULTS AND DISCUSSION

The thirteenth and fourteenth annual scoter monitoring surveys (twelfth and thirteenth annual surveys that included scaup) were conducted on Yukon Flats on 5 – 8 June, 2014, and 6 – 9 June, 2015, by pilot/observer Nikki Guldager and observer Mark Bertram. Expanded surveys were conducted 4 – 13 June, 2014 (Table 1). The survey start dates were on schedule with previous start dates. Spring breakup and May temperatures were average in 2014 and 2015 and likely had little bias on population estimates relative to previous years' survey timing. The Yukon River broke-up at Fort Yukon on 6 May 2014, and 12 May 2015, which was 3 days earlier and 3 days later than the previous 10-year mean date (9 May, range = 1 May – 21 May), respectively (http://aprfc.arh.noaa.gov/php/brkup). The mean temperature (9°C) in Fort Yukon in May 2014 was the same as the 10-year mean (2004 – 2013) (range = 5°C – 11°C), however, 2015 had the highest mean temperature relative to the previous 10 years (13°C). The minimum temperatures in May were -2 °C and -3°C in 2014 and 2015, respectively, while the previous 10-year mean minimum temperature was -6° C (range = -14 – -2°C). There were 10 and 6 days below zero in May 2014 and 2015, respectively, while the average number of days below zero from 2004 – 2013 was 11 (range = 4 – 21 days) (http://www.wcc.nrcs.usda.gov/nwcc).

Strata information, species counts, densities, and index values are presented in Tables 2 and 3. Figure 2 depicts annual trends for white-winged scoters and scaup in Yukon Flats.

Yukon Flats

Scoters

White-winged scoters accounted for 99% of indicated-total scoters observed in 2014 and 2015, and the monitoring index for the study area was 11,222 and 10,102 birds, respectively (Table 2).

The white-winged scoter estimates were a decrease from 2013, however estimates were not different from the previous 13-year mean (2001-2005 and 2007-2013, 15,403, Figure 2).

White-winged scoter trends were similar among the east, north and west strata; showing a decreasing trend from 2013 to 2014, and an increasing trend from 2014 to 2015 (Figure 3). The south strata appeared stable from 2013 to 2014, and decreased from 2014 to 2015. Overall white-winged scoter estimates for the entire study area have been relatively stable among years, however relative use of strata among years is inconsistent. High density areas shift among strata and among years. The south stratum had consistently high estimates among years, with the exception of 2015, while the east stratum was the most variable among years. Changes in the distribution of birds among strata between years indicate the importance of including all strata in population monitoring efforts. Such differential use among years may indicate selection for annually variable habitat characteristics such as water level, annual changes in breeding phenology, and/or numbers may be inflated and inconsistent due to transient birds moving through the study area on their way to breeding grounds located elsewhere.

Surf scoters accounted for 1% of the indicated-total scoters observed in 2014 and 2015, and the indexes were 170 and 85, respectively (Table 2). Few surf scoters were observed on all surveys therefore among-year variation was high. The 2001-2015 range in estimates for surf scoters was 28 – 1,034.

No black scoters (*Melanitta nigra*) were observed on the 2014 or 2015 surveys. Previous surveys indicated that very few black scoters use this area and it is doubtful that any breed on the Yukon Flats.

Scaup

The scaup monitoring indexes for 2014 and 2015 were 24,668 and 22,457, respectively (Table 1). The scaup estimates increased from 2013 (18,788), and the estimates were slightly lower in 2014 and 2015 compared to the previous 11-year mean index value for 2002 – 2013 (26,689, Figure 2).

The relative use among strata is somewhat consistent among years, with west stratum estimates being consistently higher than estimates for all other strata for all survey years (Figure 3).

Loons

The Pacific loon indexes for 2014 and 2015 were 1,672 and 1,573, respectively (Table 1). Loons were counted previously in 2007 - 2013, and the estimate range was 1,360 – 2,125. Pacific loons have the highest population indexes in the south and west strata (Figure 3).

Trumpeter Swans

The trumpeter swan population index was 836 in 2014, which was similar to the previous 7 year average from 2007 – 2013 (864). In 2015, the trumpeter swan population index was 1,601, which was inflated due to a single observation of a group of 50 swans (Table 1). Trumpeter swans have consistently had the highest population indexes in the west strata (Figure 3).

A comparison of census data to survey data in 2010 (Guldager and Bertram 2010) found that swan estimates derived from survey results were inflated, and this was likely due to their high detectability at long distances. Prior to 2011, observers were likely recording swans outside of the strip transect. In 2011, efforts were made to limit counts to within the 400 meter strip transect, causing estimates to decrease. Similar efforts were made in 2012 – 2015.

Expanded Surveys

The highest densities of white-winged scoters observed during the 2014 expanded survey were at Yukon Flats (1.15 birds/km^2). Densities in other areas were less than half the densities documented at Yukon Flats, with 0.00 (Nowitna Refuge) to 0.62 birds/km^2 (Tetlin Refuge). Surf Scoter and Black Scoter densities were low in all areas (0.00 – 0.19 birds/km^2). Scaup densities were the highest at Tetlin Refuge (3.20 birds/km^2), and ranged from 0.14 (Nowitna Refuge) to 2.54 (Yukon Flats Refuge) in other areas (Tables 2 and 3).

Management Implications

Monitoring white-winged scoter and scaup populations is important for their management as a hunted and declining species. This survey is important because these species are not well represented in Continental surveys due to their late arrival on the breeding grounds and/or nesting. Yukon Flats has some of the highest nesting densities of white-winged scoters and scaup in the Boreal forest, making this survey a valuable early warning to further population declines, which could, in turn, help trigger Continental scale management actions. There is no other extensive aerial survey tailored to these late nesters in the Boreal forest.

White-winged scoter and scaup surveys also provide information on species distribution within the Yukon Flats and the expanded areas in interior Alaska. Broad scale surveys provide information that is important for land-based management decisions such as proposed land trades, realty purchases of in-holdings, proposed access routes and roads, etc. Without spatially explicit information on species distribution and habitat, managers are unable to assess the value of potential development areas to trust species.

Recommendations

In 2014, the expanded survey provided regional population context to the Yukon Flats survey and better documented the distribution of white-winged scoters and scaup in interior Alaska. The following basic approach was used: 1) map potential white-winged scoter and lesser scaup breeding areas in boreal Alaska and Canada using existing waterfowl survey data and GIS data-layers, 2) design and implement an inventory of identified breeding areas, and 3) design an expanded breeding pair monitoring survey to make regional population inference. Expanded efforts in 2014 included steps 1 – 2.

In 2016, an aerial scoter and scaup survey will be conducted in Old Crow Flats, Yukon Territory, Canada, where white - winged scoter densities are expected to be the highest relative to areas surveyed in interior Alaska. Expanded inventory data should then be used to assess the design and feasibility of conducting an expanded monitoring survey.

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Table 1. Dates, pilot / observer teams and aircraft for expanded surveys for scoters and scaup, Alaska, 2014 and 2015.

Survey Area	Date Surveyed	Pilot / Observers	Aircraft
Yukon Flats	5 – 8 June, 2014; 6 – 9 June, 2015	Nikki Guldager / Mark Bertram	Cessna 185
Kanuti	13 June, 2014; 9 June, 2015	Mike Spindler / Tina Moran	Scout
Koyukuk	8 – 9 June, 2014	Ed Mallek / Jenny Bryant	Found Bushhawk
Minto	4 June, 2014	Nikki Guldager / Mark Bertram	Cessna 185
Nowitna	10 June, 2014	Ed Mallek / Jenny Bryant	Found Bushhawk
Tanana	11 June, 2014	Nikki Guldager / Bryce Lake	Cessna 185
Tetlin	10 June, 2014	Nikki Guldager / Bryce Lake	Cessna 185

Table 2. Indicated total number of birds counted, estimated density per stratum, and estimated total number of scoters, scaup and loons from an aerial monitoring survey conducted on the Yukon Flats, Alaska, 5 – 8 June 2014, and 6 – 9 June 2015.

			2014			2015		
Species	Stratum	Sample Area km^2 (n)[b]	Indicated Total	Density (birds/km^2)	Estimated Total	Indicated total	Density (birds/km^2)	Estimated Total
WWSC[a]	east	157.8 (16)	126	0.81	1,728	154	0.99	2,112
	north	268.1 (18)	68	0.65	1,285	86	0.82	1,625
	south	105.3 (10)	436	1.63	5,233	270	1.01	3,241
	west	119.2 (9)	162	1.03	2,453	203	1.29	3,073
	Total	650.4 (53)	792	1.15[c]	11,222[c]	713	1.04[c]	10,102[c]
SUSC[a]	east	157.8 (16)	0	0.00	0	0	0.00	0
	north	268.1 (18)	0	0.00	0	0	0.00	0
	south	105.3 (10)	10	0.04	120	4	0.01	48
	west	119.2 (9)	2	0.01	30	2	0.01	30
	Total	650.4 (53)	12	0.02[c]	170[c]	6	0.01[c]	85[c]
SCAU[a]	east	157.8 (16)	384	2.47	5,266	413	2.66	5,664
	north	268.1 (18)	265	2.52	5,008	229	2.17	4,328
	south	105.3 (10)	392	1.46	4,705	411	1.53	4,933
	west	119.2 (9)	700	4.44	10,598	532	3.37	8,055
	Total	650.4 (53)	1,741	2.54[c]	24,668[c]	1,585	2.31[c]	22,457[c]
COLO[a]	east	157.8 (16)	3	0.02	41	3	0.02	41
	north	268.1 (18)	13	0.12	246	2	0.02	38
	south	105.3 (10)	2	0.01	24	7	0.03	84
	west	119.2 (9)	2	0.01	30	4	0.03	61
	Total	650.4 (53)	20	0.03[c]	283[c]	16	0.02[c]	227[c]
PALO[a]	east	157.8 (16)	21	0.14	288	15	0.10	206
	north	268.1 (18)	12	0.11	227	16	0.15	302
	south	105.3 (10)	51	0.19	612	39	0.15	468
	west	119.2 (9)	34	0.22	515	41	0.26	621
	Total	650.4 (53)	118	0.17[c]	1,672[c]	111	0.16[c]	1,573[c]
TRSW[a]	east	157.8 (16)	6	0.04	82	3	0.02	41
	north	268.1 (18)	4	0.04	76	11	0.10	208
	south	105.3 (10)	26	0.10	312	16	0.06	192
	west	119.2 (9)	23	0.15	348	83	0.53	1,257
	Total	650.4 (53)	59	0.09[c]	836[c]	113	0.16[c]	1,601[c]

[a] WWSC = white-winged scoter, SUSC = surf scoter, SCAU = scaup, COLO = common loon, PALO = Pacific loon, TRSW = trumpeter swan, and no black scoters were observed during this survey.

[b] Total Stratum Area (km^2): west = 2,388.7, south = 3,217.3, north = 1,989.8, east = 2,132.4.

[c] Total estimate is from a model that is not strata specific.

Table 3. Indicated total number of birds counted, estimated density per stratum, and estimated total number of scoters, scaup and loons from an expanded aerial survey which included Tetlin, Koyukuk, Nowitna and Kanuti Refuges, and Minto Flats State Game Refuge and lakes area south of Tanana Village, Alaska, June 2014. Kanuti Refuge was surveyed again in June 2015.

			2014			2015		
Species	Stratum	Sample Area km^2 (n)[b]	Indicated Total	Density (birds/km^2)	Estimated Total	Indicated total	Density (birds/km^2)	Estimated Total
WWSC[a]	Kanuti	67.5	14	0.21	233	8	0.12	133
	Koyukuk	480.7	66	0.14	1,005			
	Minto	127.7	26	0.20	441			
	Nowitna	214.6	0	0.00	0			
	Tanana	199.3	6	0.03	93			
	Tetlin	103.9	64	0.62	1,070			
SUSC[a]	Kanuti	67.5	6	0.09	100	12	0.18	200
	Koyukuk	480.7	44	0.09	670			
	Minto	127.7	0	0.00	0			
	Nowitna	214.6	0	0.00	0			
	Tanana	199.3	6	0.03	93			
	Tetlin	103.9	20	0.19	334			
SCOT[a]	Kanuti	67.5						
	Koyukuk	480.7	74	0.28	2,040			
	Minto	127.7						
	Nowitna	214.6	4	0.59	1,972			
	Tanana	199.3						
	Tetlin	103.9						
SCAU[a]	Kanuti	67.5	55	0.81	915	47	0.70	782
	Koyukuk	480.7	308	0.64	4,688			
	Minto	127.7	178	1.39	3,020			
	Nowitna	214.6	29	0.14	448			
	Tanana	199.3	36	0.18	559			
	Tetlin	103.9	333	3.20	5,568			
COLO[a]	Kanuti	67.5	2	0.03	33	3	0.04	50
	Koyukuk	480.7	46	0.10	700			
	Minto	127.7	3	0.02	51			
	Nowitna	214.6	6	0.03	93			
	Tanana	199.3	2	0.01	31			
	Tetlin	103.9	1	0.01	17			
PALO[a]	Kanuti	67.5	4	0.06	67	6	0.09	100
	Koyukuk	480.7	10	0.02	152			
	Minto	127.7	2	0.02	34			
	Nowitna	214.6	1	0.00	15			
	Tanana	199.3	0	0.00	0			
	Tetlin	103.9	10	0.10	167			

Species	Stratum	Sample Area km^2 (n)[b]	2014 Indicated Total	2014 Density (birds/km^2)	2014 Estimated Total	2015 Indicated total	2015 Density (birds/km^2)	2015 Estimated Total
SWAN	Kanuti	67.5	34	0.50	566	14	0.21	233
	Koyukuk	480.7	111	0.25	1,833			
	Minto	127.7	142	1.11	2,409			
	Nowitna	214.6	25	0.19	620			
	Tanana	199.3	31	0.16	481			
	Tetlin	103.9	76	0.73	1,271			

[a] WWSC = white-winged scoter, SUSC = surf scoter, SCOT = unknown scoter, SCAU = scaup, COLO = common loon, PALO = Pacific loon, SWAN = trumpeter or tundra swan, and no black scoters were observed during this survey.

[b] Total Stratum Area (km^2).

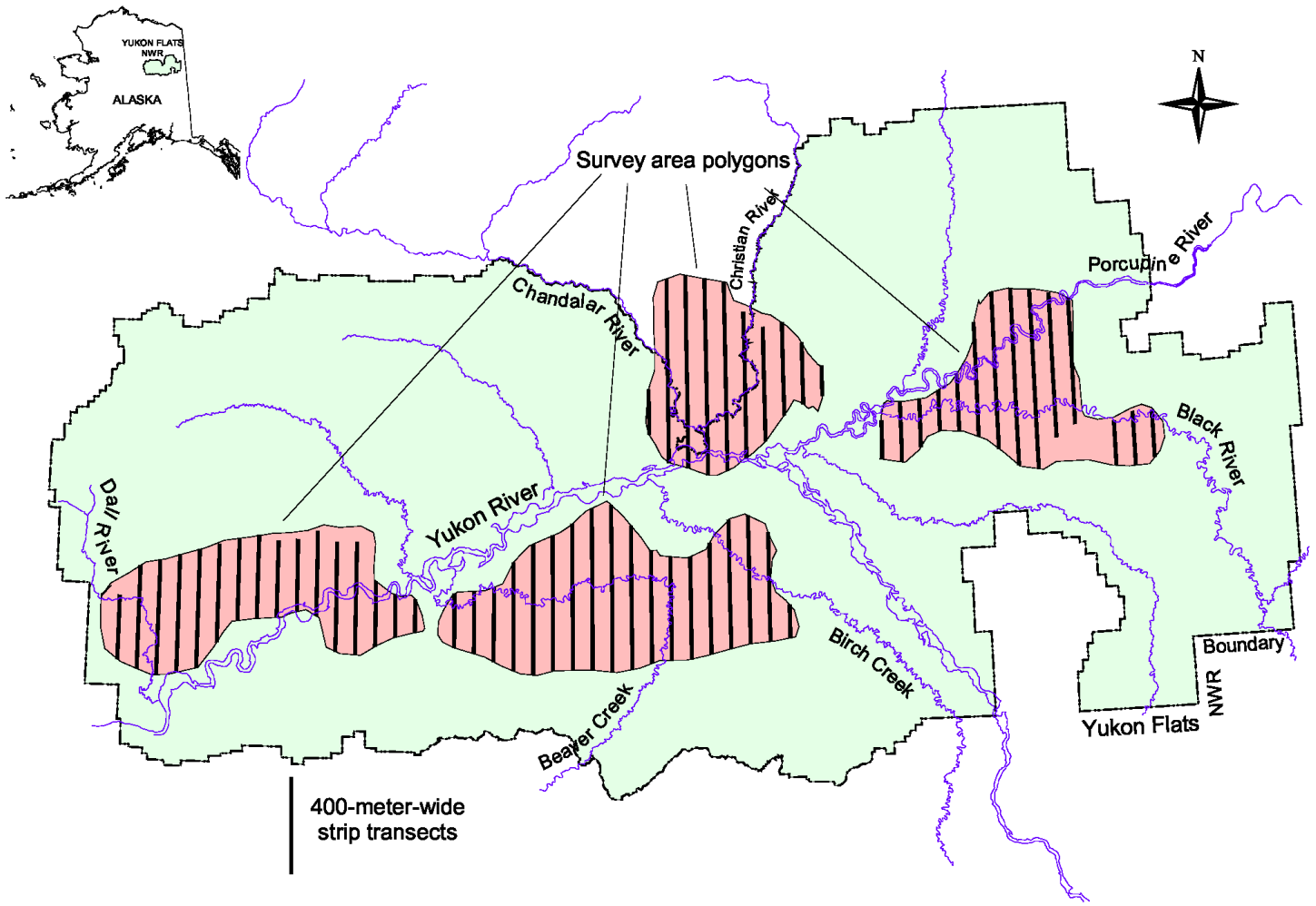
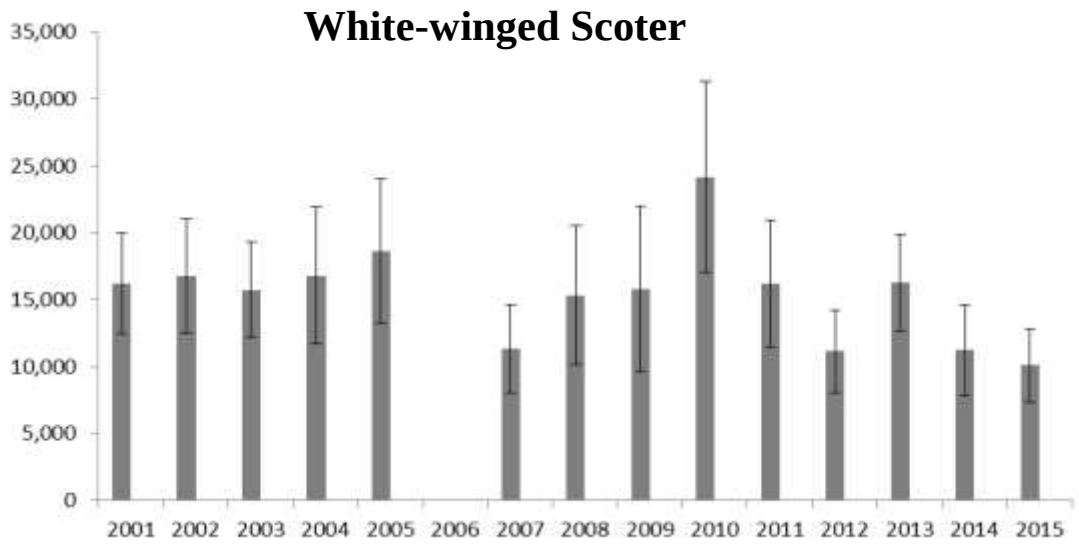
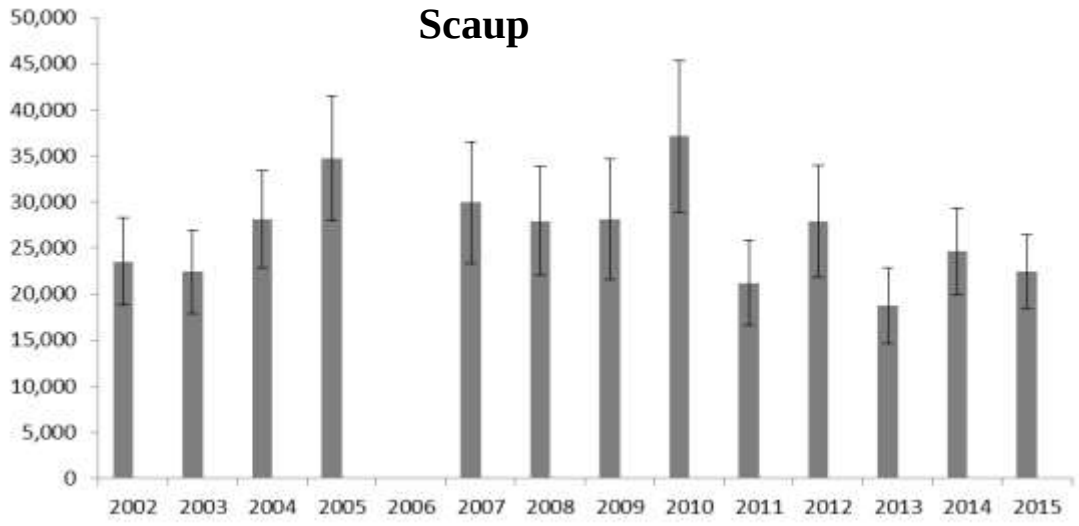


Figure 1. Map features of the Yukon Flats, Alaska in relation to the transect locations, 2001 – 2015.



a)



b)

Figure 2. Estimated total number of a) white-winged scoters and b) scaup for the Yukon Flats study area from 2001 and 2002, respectively, to 2015. Error bars are 95% confidence limits.

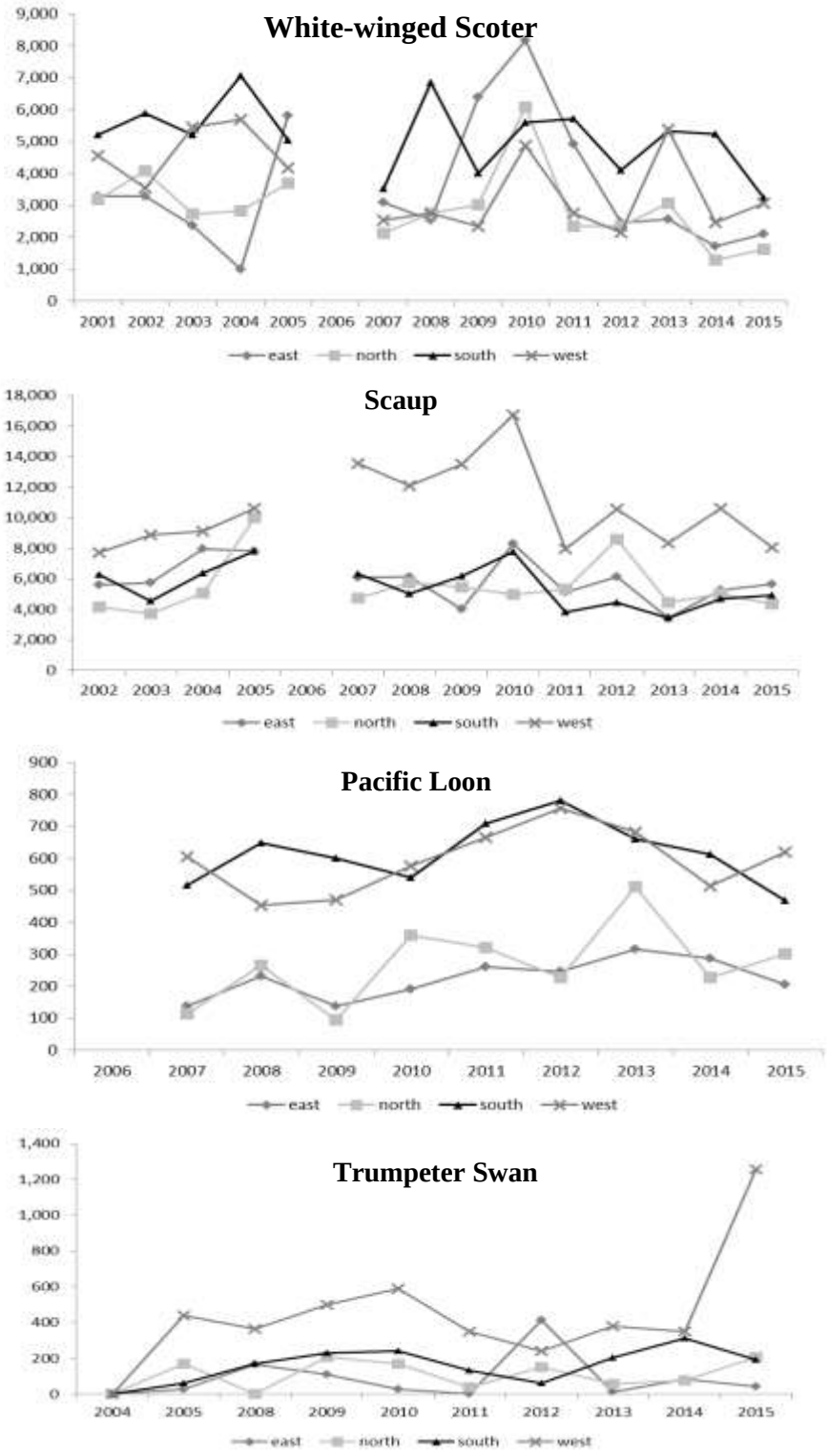


Figure 3. Estimated total number of white-winged scoters, scaup, Pacific loons, and trumpeter swans by strata from an aerial monitoring survey conducted on the Yukon Flats, Alaska, June 2001 - 2015. A survey was not conducted in 2006, scaup were not surveyed in 2001, loons were not surveyed in 2001 – 2006, and trumpeter swans were not surveyed in 2001 – 2004, 2006, and 2007.

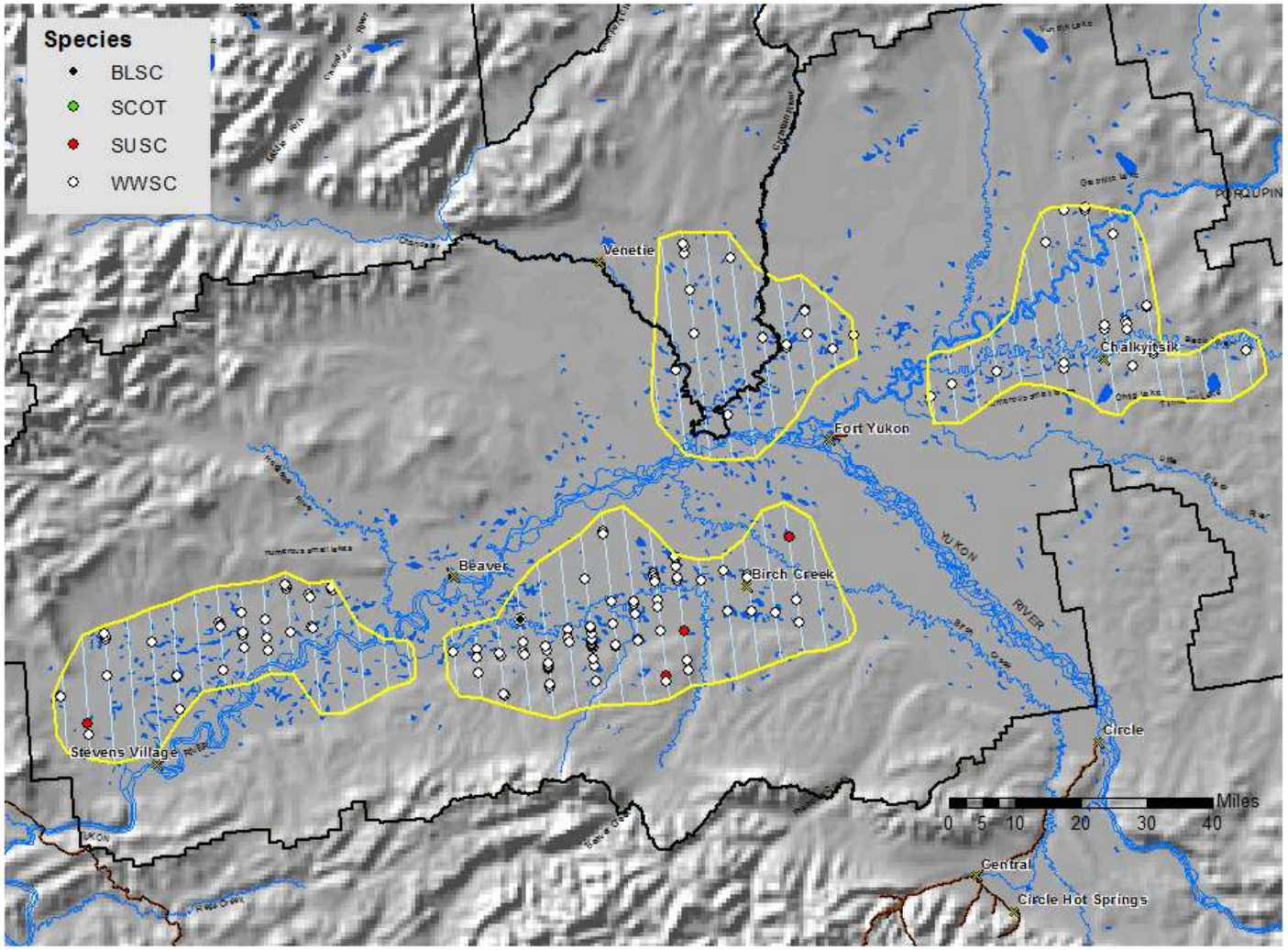


Figure 4. Distribution of black (BLSC), surf (SUSC), white-winged (WWSC) and unknown scoter observations for Yukon Flats, Alaska, 2014. Study area and survey transects are depicted in yellow and blue, respectively.

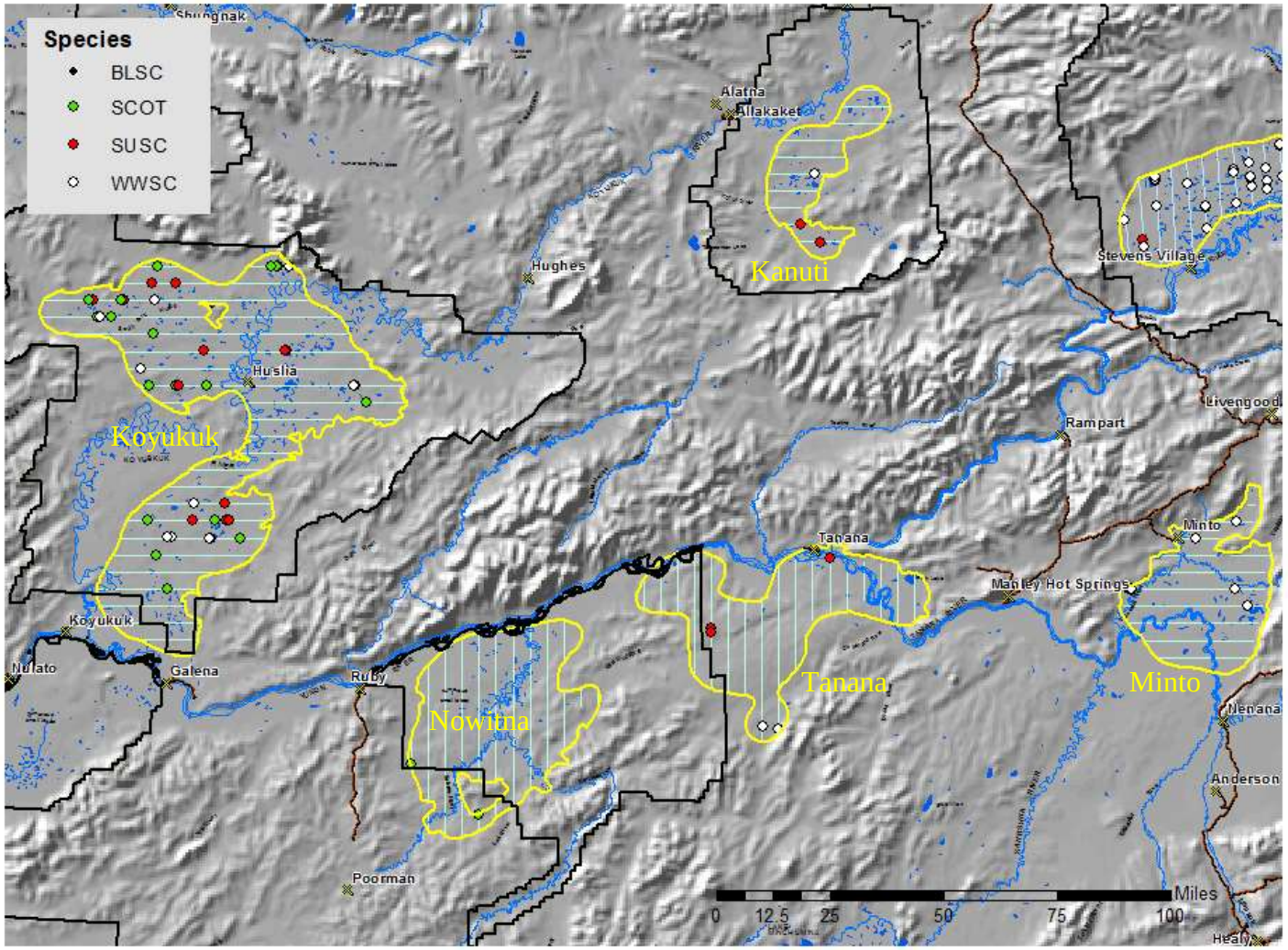


Figure 5. Distribution of black (BLSC), surf (SUSC), white-winged (WWSC) and unknown scoter observations for Koyukuk, Nowitna, lakes south of Tanana, Kanuti, and Minto Flats, Alaska, 2014. Study area and survey transects are depicted in yellow and blue, respectively.

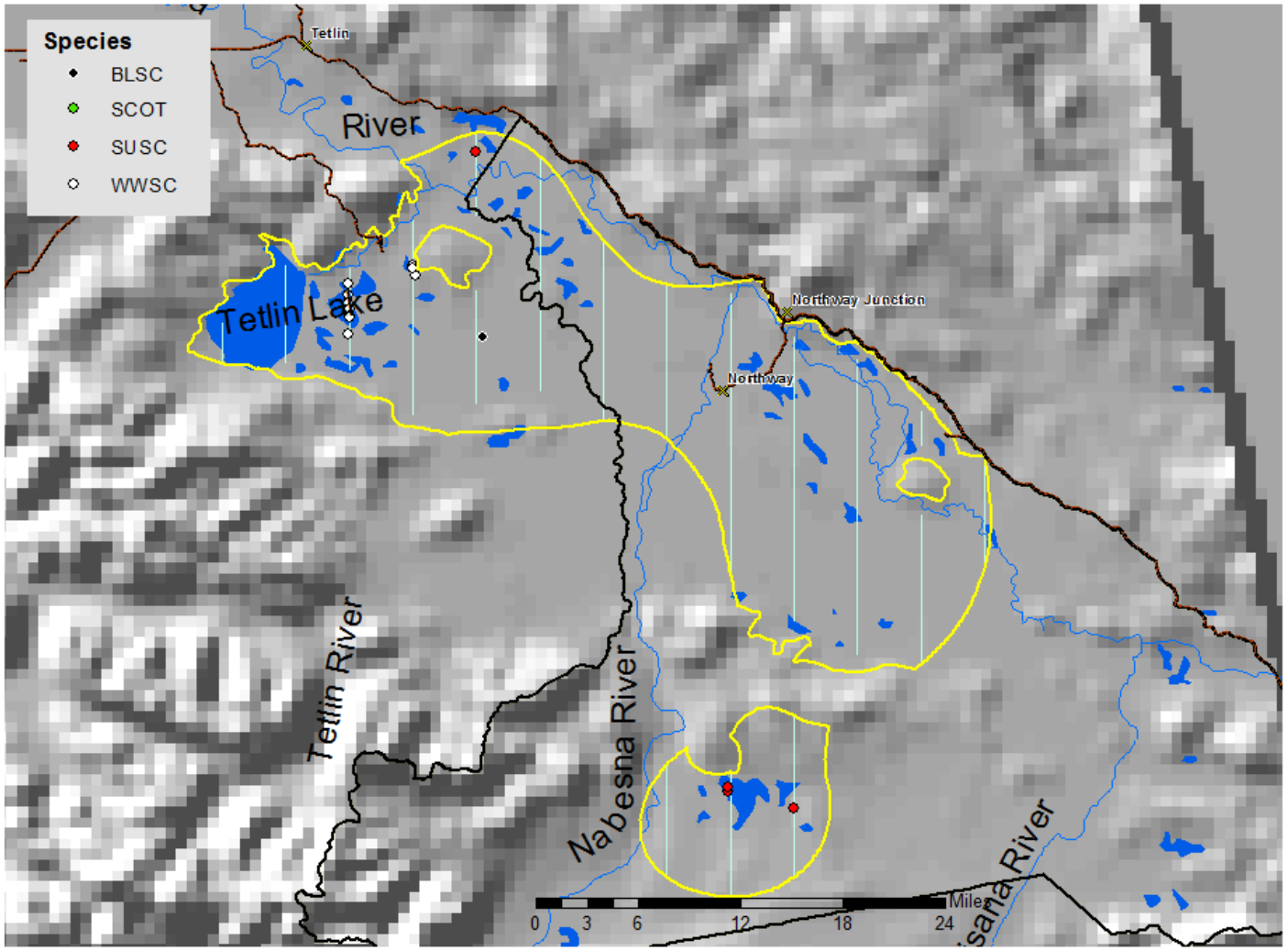


Figure 6. Distribution of black (BLSC), surf (SUSC), white-winged (WWSC) and unknown scoter observations for Tetlin National Wildlife Refuge, Alaska, 2014. Study area and survey transects are depicted in yellow and blue, respectively.

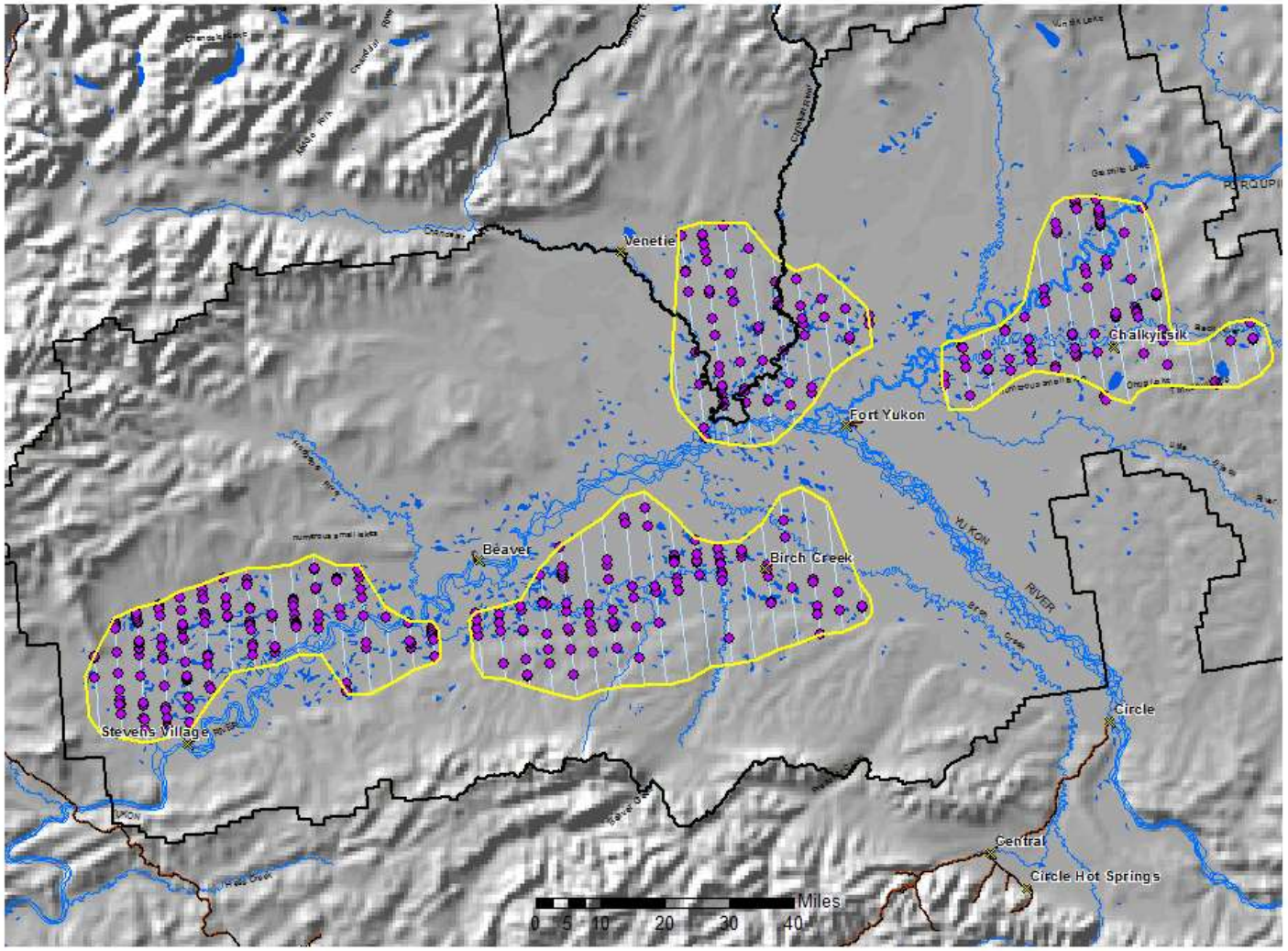


Figure 7. Distribution of scaup observations for Yukon Flats, Alaska, 2014. Study area and survey transects are depicted in yellow and blue, respectively.

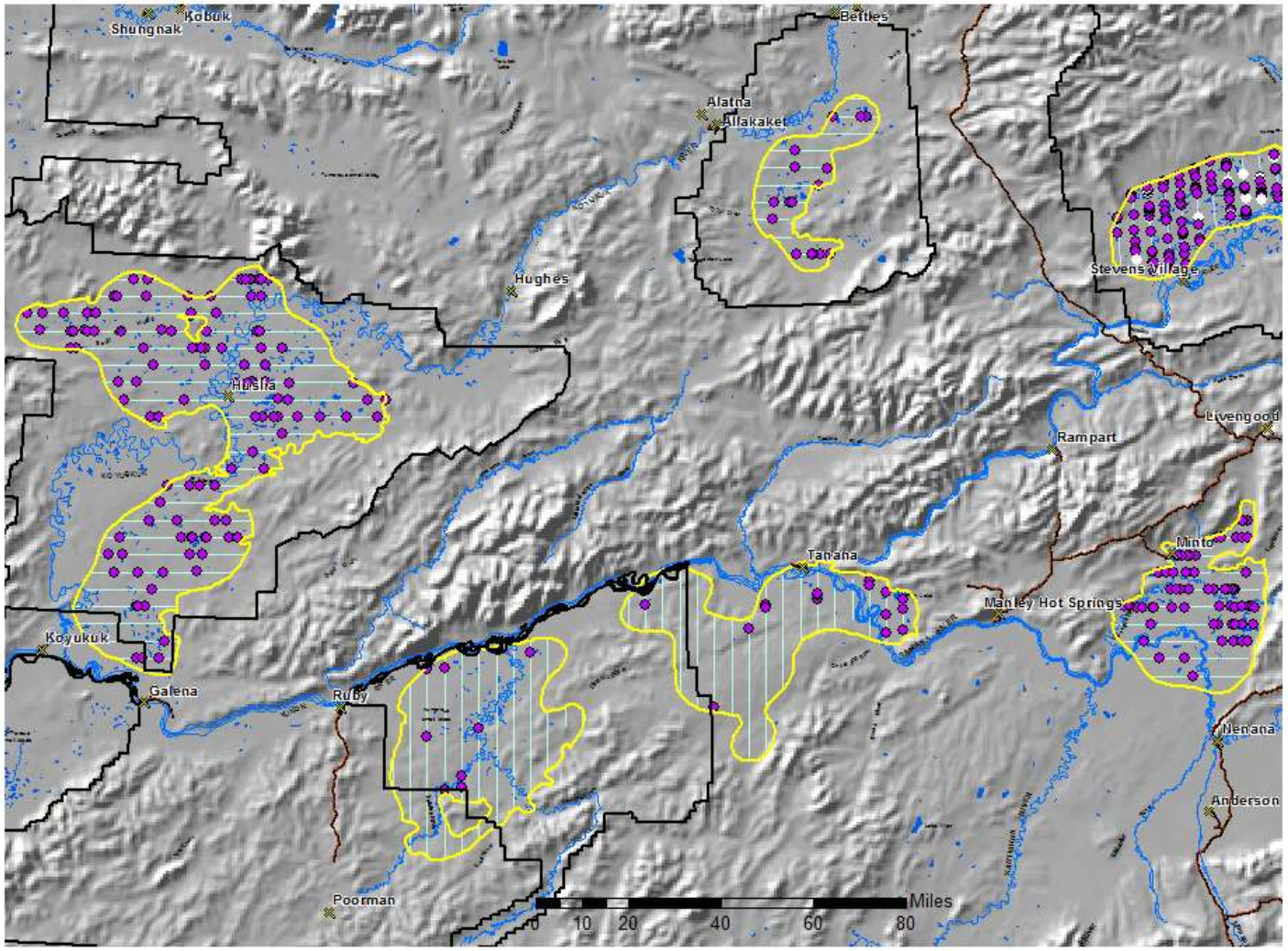


Figure 8. Distribution of scaup observations for Koyukuk, Nowitna, lakes south of Tanana, Kanuti, and Minto Flats, Alaska, 2014. Study area and survey transects are depicted in yellow and blue, respectively.

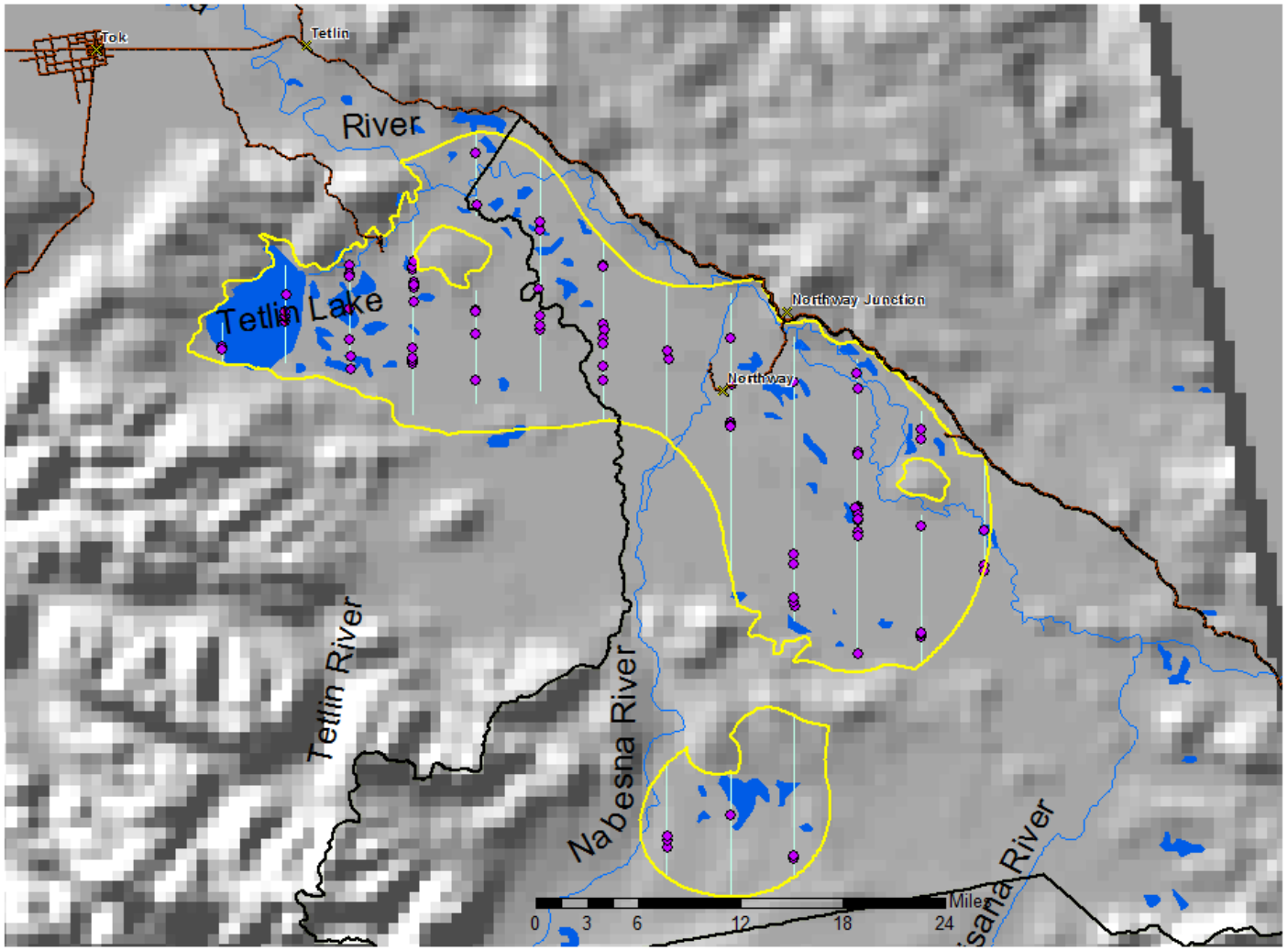


Figure 9. Distribution of scaup observations for Tetlin National Wildlife Refuge, Alaska, 2014. Study area and survey transects are depicted in yellow and blue, respectively.